

Claims:

1. A pitch sensor tool for a stem boring or drilling machine having a stem and a drilling head, comprising:

5 a generally cylindrical housing adapted to be coupled to said stem and to said drilling head,

a pitch sensing device, the pitch sensing device being disposed in or on the housing and being adapted to transmit a reading of the sensed pitch of the pitch sensor tool.

10 2. The pitch sensor tool of claim 1, wherein the pitch sensing device is fixedly mounted in or on the pitch sensing tool and separated therefrom by a shock absorbing material.

15 3. The pitch sensor tool of claim 1 or 2, wherein pitch sensing device is mounted within a compartment within the pitch sensing tool.

20 4. The pitch sensor tool of any of claims 1 to 3, wherein the pitch sensing device is mounted for movement inside and relative to the pitch sensor tool about the axis of rotation of the pitch sensor tool, preferably whereby, in use, the pitch sensing device remains substantially stationary.

25 5. The pitch sensor tool of claim 4, wherein the pitch sensing device is mounted on wheels within a cylindrical compartment inside the pitch sensor tool, whereby the pitch sensing device runs on said wheels over the cylindrical internal surface of the compartment.

30 6. The pitch sensor tool of claim 4, wherein the pitch sensing device is mounted within and coupled to a cylindrical compartment inside the pitch sensor tool via bearings, whereby the pitch sensing device is free to rotate with respect to the pitch sensor tool.

7. The pitch sensor tool of claim 6, wherein the pitch sensing device is mounted on an axle, the axle being mounted at each end thereof in bearings fixedly attached in said cylindrical compartment.

8. The pitch sensor tool of claim 7, wherein the pitch sensing device has weights attached at, on or near the base thereof, thereby facilitating said pitch sensing device remaining stationary while said pitch sensor tool, in use, rotates.

9. The pitch sensor tool of any of the preceding claims, wherein the pitch sensing device is mounted in or on the pitch sensing tool at perfect zero percent prior to use, whereby when the pitch sensing tool is in an actual horizontal position, said reading of the sensed pitch transmitted by the pitch sensing device is zero.

10. The pitch sensor tool of any of the preceding claims, further including a female engagement portion for engagement, in use, by a male engagement portion of the stem.

11. The pitch sensor tool of any of the preceding claims, further including a male engagement portion for engagement, in use, by a female engagement portion of the drilling head.

12. The pitch sensor tool of any of the preceding claims, further including a battery compartment housing a battery for powering the pitch sensing device.

13. A boring or drilling tool, comprising:
the pitch sensing tool of any of the preceding claims, and
a drilling head, the drilling head including a drill bit.

14. The boring or drilling tool of claim 13, wherein the drilling head includes a housing having a clock sensor mounted therein, the clock sensor being adapted to transmit a reading indicative of the sensed angular position of the drill bit.

15. A stem boring or drilling machine, comprising:
a stem,

a drive section for applying rotational energy to the stem,
a pitch sensor tool according to any of claims 1 to 12, and
a drilling head, the drilling head including a drill bit.

wherein the pitch sensor tool is disposed between the stem and the drilling head and
5 mechanically coupled to each.

16. The boring or drilling machine of claim 15, wherein the stem is a dual stem comprising inner and outer sections, and the pitch sensing device is mounted on a non-rotating outer section of the pitch sensor tool.

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17. The boring or drilling machine of claim 15, wherein the stem is a single stem, and the pitch sensing device is fixedly mounted on the pitch sensor tool and rotates, in use, therewith.

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18. The pitch sensor tool, boring or drilling tool, or stem boring or drilling machine substantially as hereinbefore described with reference to the accompanying drawings.